AXAF Science Center

Harvard–Smithsonian Center for Astrophysics

MEMORANDUM

March 1, 1996

File: /home/garcia/axaf/asc/mp/guide.stars/gssa/test.v2.1/mpwgtel2.tex

To: MPSWG Members

From: Michael Garcia

Subject: Fraction of Sky Accessible in Single 180^o Slew

This memo is in response to an action item taken at the MPSWG Telecon Feb 14, 1996. Reference material includes:

SAO Memo From Robert Cameron, Feb 14, 1995, "Constraints on selection of acquisition stars"

TRW Memo AXAF.95.333.011, S. Parker, 24 Feb 1995, "Preliminary Requirements for Worst-Case Acquisition Star Algorithm"

ASC Memo From Michael Garcia, May 3, 1995, "Tests of Acquisition Star Algorithm, V2.1"

The action item was to assess the fraction of AXAF targets which could be slewed to directly and lock onto acquisition stars in a worst-case 180^o slew. The concern is that the acquisition stars may have "spoofers" in the search region, therefore causing the ACA to lock up on the wrong star.

The problem was addressed by running the ASC prototype acquisition star selection algorithm (SSA V2.1) with a range of "search_box_sizes", representing a range in gyro pointing errors after a 180^o slew. The potential target list was taken from the the first $\sim$ 1000 Einstein pointings in a RA sorted list, which covers a range in galactic latitude and may be representative of AXAF pointing lists. Potential acquisition stars were selected from the AGASC (V1.0). Stars within 1.62 magnitudes, and within the "clear_circle" were taken as spoofer stars. As there is no color information in AGASC V1.0, magnitudes were computed based on an average correction from the HST magnitudes to the ACA bandpass. FID lights

search_box_size (sbs), SSA parameter	clear_circle $= 2 \times \sqrt{(2)} \times sbs$	fraction accessible	RAC Fig 1 clear search region $= 2 \times 4\sigma$ eqiv 4σ error	RAC page 3 SSA Acq QC clear region $= 2 \times \sqrt{(2)} \times 4\sigma$ eqiv 4σ error
$133''$	$372''$	99%	$186''$	$133''$
$200''$	$560''$	90%	$280''$	$200''$
$267''$	$747''$	65%	$373''$	$267''$
$600''$	$1680''$ ($28'$)	0.2%	$840''$	$600''$

Table 1: Results of Trial Acquisition Star Selection, SSA V2.1, AGASC V1.0

were also considered as "spoofers", if they were within the "clear_circle" of the candidate acquisition star.

Column one lists the SSA parameter "search_box_size". Figure 1 below describes how this parameter is used in the algorithm. Column two lists the radius of the circle which is searched for potential spoofers (stars within 1.62 magnitudes of the potential acquisition star).

Column three lists the "fraction accessible", this is the fraction of targets from a potential AXAF list for which two or more Acquisition stars could be found in the AGASC, given the clear_circle requirement in column 2. Note that this is NOT the *probability* of a successful acquisition of the stars, that is either 100% or 0% for any given target/slew combination. This number is the fraction of the set of trial target/slew combinations for which the probability of success is 100%. One can determine if any given target/slew is possible BEFORE attempting the maneuver, and break the maneuver into pieces if need be.

Column four lists the equivalent 4σ gyro error from Figure 1 of Rob Cameron's memo on Feb 14, 1995 "Constraints on selection of acquisition stars". This is the appropriate error to use if the ACA searches for potential acquisition stars in a circle (rather than in a square). It also is appropriate if the SSA filters potential acquisition stars with quality codes built into the AGASC.

Column five lists the equivalent 4σ gyro error if the ACA searches in a square, and the SSA uses built in quality codes for star selection, after page 3 of Rob Cameron's memo of Feb 14, 1995.

If the ACA searches in a box, and the filtering (selection) of acquisition stars is done in a square (which would require it to be done in OFLS and for a pre-determined roll), then

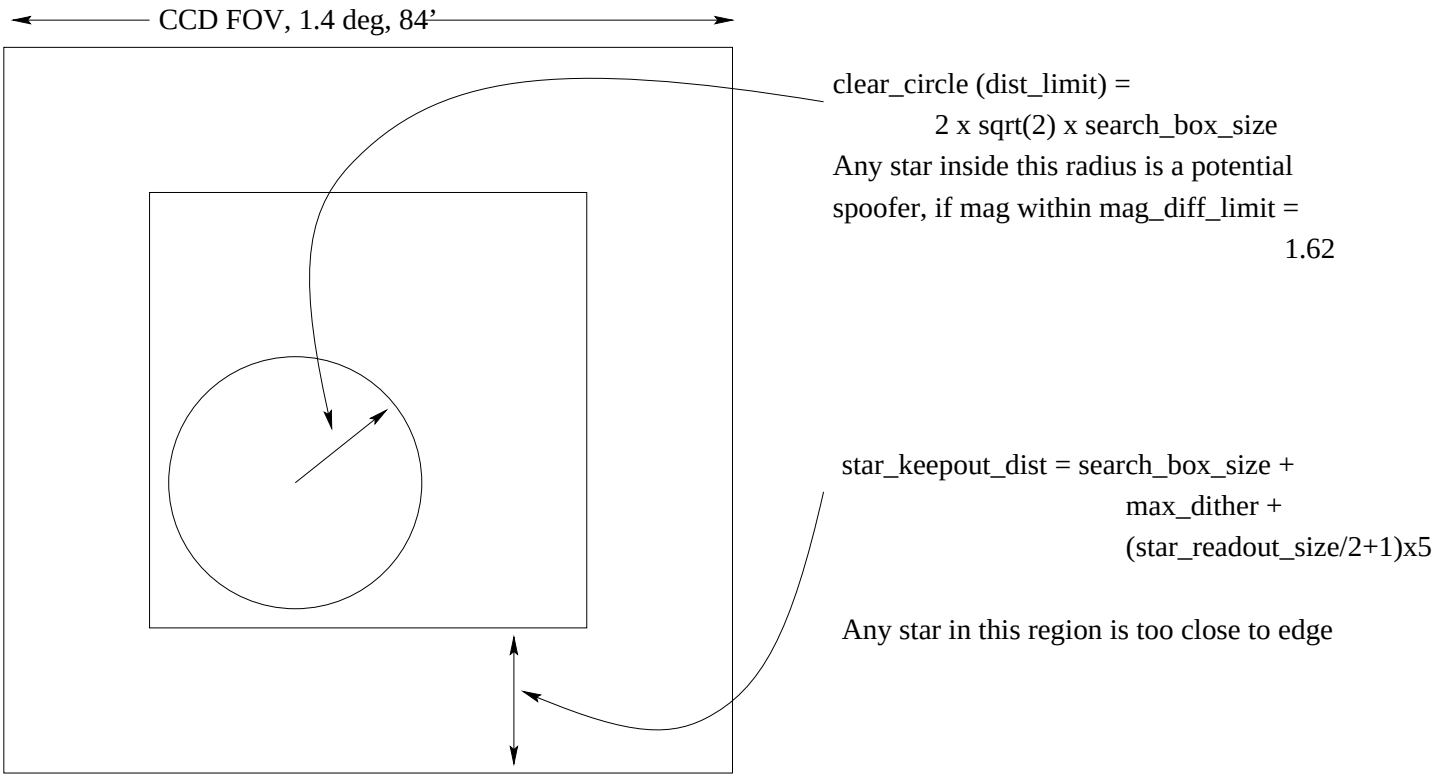

Figure 1: Usage of SSA Parameter "search_box_size"

the appropriate 4σ error is somewhere in between columns four and five.